DETAILED ACTION

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1, 4-7 and 12 are rejected under 35 U.S.C. 102(b) as being anticipated by Hirokane et al. 6,150,038 (hereinafter Hirokane).

Regarding claim 1, Hirokane teach a recording medium comprising a storage layer for thermally-assisted writing of information to said recording medium (1, 2 and 3 of Fig. 1, Col 5 Lines 48-63), said storage layer comprising a stack including at least two sub-layers (1, 2 and 3 of Fig. 1, Col 5 Lines 48-63, the first, second and third magnetic layer), wherein said sublayers are antiferromagnetically coupled through a non-magnetic layer (14 and 15 of Fig. 4, Col 7 Lines 60-65), and wherein at least in a temperature range below the writing temperature the magnitude of the overall magnetization of the storage layer is substantially smaller than the magnitude of the magnetization of each of the sub-layers (Col 9 Lines 46-53) and said sublayers have an anisotropy favoring around room temperature an orientation of the magnetization perpendicular to the film plane (Col 6 Lines 1-6).

Regarding claim 4, Hirokane teach a recording medium according to claim 1 wherein said sub-layers consist of a rare-earth transition-metal alloy including at least Tb and Fe as elements (Col 9 Lines 32-50).

Regarding claim 5, Hirokane teach a recording medium according to claim 1, wherein said sublayers include a thin transition metal layer at the interface with the non-magnetic layer (1 of Fig. 4, Col 8 Lines 60-65).

Regarding claim 6, Hirokane teach a recording medium according to claim 1, wherein said sublayers are adapted to have different thicknesses (Col 9 Lines 21-31, Col 9 Lines 66-67, Col 10 Lines 47-49 the thickness of the layers may be of different values).

Regarding claim 7, Hirokane teach a recording medium according to claim 1, wherein said sublayers are adapted to have different Curie temperatures (Col 9 Lines 5-7, Col 9 Lines 49-51, Col 10 Lines 38-39, Col 6 Lines 22-27 the Curie temperatures of the layers may be of different values)

Regarding claim 12, the limitations have been analyzed and rejected with respect to the recording medium above in claim 1. It would have been obvious to one of ordinary skill in the art to understand the recording medium would require a method of manufacturing to be created

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 2-3 and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hirokane US 6,150,038 as applied to claim 1 above, and further in view of Van Kesteren et al. US 5,756,202 (hereinafter Van Kesteren).

Regarding claim 2, Hirokane fail to teach a recording medium according to claim 1, wherein said non-magnetic layer is a Ru layer.

However, Van Kesteren teaches that the antiferromagnetic coupling material is selected from the group formed by V, Cr, Mn, Cu, Nb, Mo, Ru, Rh, Ta, W, Re, Os, Ir, and mixtures thereof (Col 4 Lines 19-34). Therefore, it would have been obvious to one of ordinary skill in the art to combine the teachings of Van Kesteren and Hirokane to select Ru for a non-magnetic metallic layer for the specific thickness of the layer needed for the benefit of inducing a strong coupling (Col 4 Lines 24-27).

Regarding claim 3, Hironkane fail to teach a recording medium according to claim 1, wherein said non-magnetic layer has a thickness in between 0.5 and 1.5 nm.

However, Van Kesteren teaches the Ru layer has a thickness ranging from 0.5nm to 1.5nm (Col 4 Lines 35-49). Therefore, it would have been obvious to one of ordinary skill in the art to combine the teachings of Van Kesteren and Hirokane to select a specific thickness for the Ru layer for the benefit of inducing a strong coupling (Col 4 Lines 44-49).

Regarding claim 8, Hironakne fail to teach a recording medium according to claim 1, wherein the Kerr rotation or Kerr ellipticity of the recording stack has a larger magnitude for the antiparallel than for the parallel orientation of the sublayer magnetizations.

However, Van Kesteren teach a recording medium according to any one of claim 1, wherein the Kerr rotation or ellipticity of the recording stack (the relative Kerr rotation contributions from parts P_1 and P_2, Col12 Line 8) has a larger magnitude for the antiparallel than for the parallel orientation of the sub layer magnetizations (A third magnetic switching field H_{s3}, for switching magnetizations in part P_1 out of parallel orientation with respect to corresponding magnetizations in part P_2 and into anti-parallel orientation with respect thereto, is larger than a fourth magnetic switching field H_{s4}, for switching magnetizations in part P_2 out of parallel orientation with respect to corresponding magnetizations in part P_1 and into anti-parallel orientation with respect thereto, Col 6 Lines 32-42). Therefore, it would have been obvious to one of ordinary skill in the art to combine the teachings of Van Kesteren and Hirokane to increase the magnitude of the Kerr rotation than the magnetizations sub layer for the benefit of allowing the strength of the AF coupling to be tailored to the desired performance (Col 4 Lines 27-34).

Claims 9-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hirokane US 6,150,038 as applied to claim 1 above, and further in view of Awano et al. US 6,633,514 B1 (hereinafter Awano).

Regarding claim 9, Hirokane fail to teach a recording medium according to claim 1, wherein said double-layer structure is incorporated in an MSR stack.

However, Awano teach the use of MSR in the double layer structure (Col 2 Lines 8-34). Therefore, it would have been obvious to one of ordinary skill in combine the

teachings of Awano and Hirokane for the purpose of utilizing the super resolution technique for the benefit of improving the reproducing resolution (Col 2 Lines 27-31).

Regarding claim 10, Hirokane fail to teach a recording medium according to claim 9, wherein said sublayers and non-magnetic layer are part of a DWDD stack and adapted in such a way that the magnitude of the magnetization of the storage layer as a whole at the readout temperature is substantially lower than the magnitude of the magnetization of each sublayer.

However, Awano teach sublayers and non-magnetic layer as part of a DWDD stack and the readout temperature of the storage layer is lower than the magnetization of each sublayer (Col 64 Line 51-Col 65 Line 5). Therefore, it would have been obvious to one of ordinary skill in combine the teachings of Awano and Hirokane for the purpose of utilizing the DWDD stack for the sublayers and non-magnetic layer and to increase the temperature of the storage layer to be lower than the magnetization of the sublayer for the benefit of dramatically increasing the reproduction density.

Regarding claim 11, Hirokane fail to teach a recording medium according to claim 9, wherein said recording medium is a MAMMOS recording medium.

However, Awano teach the recording medium is a MAMMOS recording medium (Col 64 Line 51-Col 65 Line 5). Therefore, it would have been obvious to one of ordinary skill in combine the teachings of Awano and Hirokane for the purpose of using a recording medium that is a MAMMOS recording medium for the benefit of dramatically increasing the reproduction density.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kezhen Shen whose telephone number is (571) 270-1815. The examiner can normally be reached on Monday-Friday 10am-6pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wayne Young can be reached on (571) 272-7582. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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Examiner, Art Unit 2627

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